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AUTHOR Crawley, Frank E.; dos Santos Silva, Maria Virginia

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ABSTRACT

Presented are the results of a Delphi study designed to determine the objectives of secondary science methods courses and the concerns of the professors who plan them. The results present, in the order of importance, the three following concerns: (1) planning one or more science lessons, (2) constructing a classroom evaluation scheme, and (3) designing remedial activities for students who lack prerequisite skills for a given set of objectives. Implications and applications of the information are discussed. (Author/SA)

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DEVELOPMENT OF A DECISION-MAKING MODEL FOR DESIGNING A METHODS COURSE FOR PROSPECTIVE SECONDARY SCIENCE TEACHERS: A DELPHI STUDY

A Contributed Paper

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by

Frank E. Crawley
Science Education Center
University of Texas at Austin

Maria Virginia dos Santos Silva
Universidade Federal De Santa Maria
Santa Maria, Brazil

SE 030 563

Purpose of the Study

The purpose of this paper is to present the results of a study of the objectives of secondary science methods courses and the concerns of instructors when planning methods courses. Specifically the study was designed (1) to seek the opinions of university professors of science education to obtain and compare priorities and areas of concern in planning a science methods course for secondary school teachers; (2) to determine the degree of importance and consensus existing among those experts regarding the different objectives and concerns which they have identified; and (3) to discover how the concerns of those educators were related to their judgment of the importance of the objectives.

Introduction to the Study

A science methods course should be one of the most significant courses in the preparation of a prospective science teacher. Indeed, it is supposed to provide the prospective teacher with the teaching strategies and tactics for teaching science, knowledge of pedagogical concepts and principles, and should develop in him relevant attitudes. Research studies focusing on the methods course for prospective secondary science teachers tend to focus on objectives that reflect the instructor's strengths, interest, and personal philosophy (eg. Anderson, 1969; Druger, 1969; Bicak, 1975; and Golman, 1975). Other researchers prefer to focus on the skills needed to effectively teach secondary school science (eg. Spore, 1962; Qureshi, 1975; Simpson and Brown, 1977; and Chiapetta and Collette, 1978).

The concerns of preservice teachers offer a valuable insight into the frame of reference of the prospective secondary science teacher, information which can be extremely useful in planning the methods course. Researchers (Fuller, 1969

and Spivey, 1976) have found that preservice and inservice teachers move through predictable developmental stages of concern, focusing first on self concerns, then task concerns, and finally impact concerns. It would seem logical for instructors in charge of planning a secondary science methods course to also possess differing concerns or philosophical bases for arriving at course objectives.

Design of the Study

To accomplish this study, the Delphi technique (Helmer, 1967) was employed to obtain and compare the opinions of twenty-four university professors of science education. Pfeiffer's (1968) procedure was modified to one instead of two rounds of questionnaires following feedback. A list of fifteen objectives and five areas of concern was compiled. Consensus was obtained for all fifteen objectives, although at different levels of importance. Concerns were ranked according to their order of importance. The collection of data covered approximately four months, May through August, 1979.

Results of the Study

Fifteen objectives were identified and rated from somewhat important to very important. Of the five areas of concern identified (teacher, student, subject-matter, society, and curriculum) two were deleted. Society concerns received only one first place ranking, and curriculum concerns received neither a first nor second place ranking from panel members. Results of the rating of objectives and rankings of concerns are found respectively in Tables 1 and 2.

It was found that only three objectives occupied the same rank order for the three major groups expressing different concerns. First in order of importance was objective five (plan one or more science lessons). In second place was objective nine (construct a classroom evaluation scheme). The unanimous choice

TABLE 1

ANALYSIS OF RESPONSES TO ROUND THREE DELPHI QUESTIONNAIRE

PART I (N = 24)

OBJECTIVES/RATING*	1		2		3		4		5		Mean	Deviation	% Above Or Below 3
	No.	%	No.	%	No.	%	No.	%	No.	%			
1. Teach one or more science lessons.	1	4.2	0	0.0	1	4.2	3	12.5	19	79.1	4.62	.92	+ 92
2. Make a collection of teacher resource materials for a science area.	1	4.2	1	4.2	1	4.2	16	66.7	5	20.8	3.95	.90	+ 88
3. Design a plan for incorporating safety procedures into all aspects of science classroom teaching.	0	0.0	2	8.3	3	12.5	11	45.8	8	33.3	3.90	.88	+ 79
4. Plan an entire laboratory investigation.	0	0.0	1	4.2	1	4.2	5	20.8	17	70.8	4.58	.77	+ 92
5. Plan one or more science lessons.	0	0.0	0	0.0	0	0.0	2	8.3	22	91.7	4.91	.28	+ 100
6. Describe ways to provide for unusual emotional and physical needs of students when planning science lessons	0	0.0	0	0.0	10	41.7	12	50.0	2	8.3	3.66	.63	+ 58
7. Design remedial activities for students who lack prerequisite skills for a given set of objectives.	1	4.2	2	8.3	5	20.8	13	54.2	3	12.5	3.56	.94	+ 67
8. Construct a long range teaching (unit) plan.	0	0.0	1	4.2	2	8.3	7	29.1	14	58.3	4.41	.82	+ 87
9. Construct a classroom evaluation scheme.	0	0.0	1	4.2	1	4.2	5	20.8	17	70.8	4.58	.77	+ 92
10. Describe interpersonal skills and strategies that are effective in dealing with adolescent behavior.	1	4.2	0	0.0	3	12.5	10	41.7	10	41.7	4.16	.96	+ 83
11. Describe the implications of science teaching.	0	0.0	0	0.0	3	12.5	10	41.7	11	45.8	4.33	.70	+ 88
12. Analyze the results of student attainment.	0	0.0	0	0.0	1	4.2	6	25.0	17	70.8	4.66	.56	+ 96
13. Design procedures for obtaining information as to the effectiveness of your teaching.	1	4.2	0	0.0	3	12.5	11	45.8	9	37.5	4.12	.94	+ 83
14. Explain the role of a science teacher as a professional.	0	0.0	2	8.3	2	8.3	16	66.7	4	16.7	3.91	.77	+ 83
15. Describe the role of learning theories in science teaching.	1	4.2	2	8.3	4	16.7	7	29.1	10	41.7	3.95	1.16	+ 71

* 1 = Very Unimportant; 5 = Very Important

TABLE 2

ANALYSIS OF RESPONSES TO ROUND THREE DELPHI QUESTIONNAIRE

PART II (N = 24)

	RANK OF IMPORTANCE											
	1		2		3		4		5			Standard
CONCERNS	No.	%	No.	%	No.	%	No.	%	No.	%	Mean	Deviation
Curriculum	0	0.0	2	8.3	1	4.2	8	33.3	13	54.2	1.66	.91
Student	4	16.7	14	58.3	3	12.5	3	12.5	0	0.0	3.79	.88
Subject-matter	5	20.8	2	8.3	6	25.0	4	16.7	7	29.2	2.75	1.51
Society	1	4.2	2	8.3	8	33.3	9	37.5	4	16.7	2.45	1.02
Teacher	14	58.3	4	16.7	6	25.0	0	0.0	0	0.0	4.33	.86

for eighth place, and the last in the student concerns group, was objective seven (design remedial activities for students who lack prerequisite skills for a given set of objectives). The remaining objectives did not follow a predictable pattern among the groups.

Conclusions and Implications

To plan a secondary science methods course using the results of this study the instructor first identifies his major planning concern (teacher, student, subject-matter), then locates the list of objectives that a "panel of experts" expressing a similar concern considers to be of greatest priority. Table 3 contains the ordering of objectives for each of the three concerns groups.

TABLE 3

ORDERING OF OBJECTIVES FOR EACH CONCERNS GROUP

ORDER OF IMPORTANCE* \ CONCERNS GROUP	TEACHER (N = 14)	SUBJECT MATTER (N = 5)	STUDENT (N = 4)
1	Obj. 5	Obj. 5 Obj. 12	Obj. 1 Obj. 5
2	Obj. 1 Obj. 4 Obj. 9	Obj. 9 Obj. 11	Obj. 9
3	Obj. 8 Obj. 12	Obj. 4	Obj. 4 Obj. 12 Obj. 13
4	Obj. 10 Obj. 11 Obj. 13	Obj. 3	Obj. 8
5	Obj. 3 Obj. 15	Obj. 1 Obj. 2 Obj. 8 Obj. 10	Obj. 14
6	Obj. 2	Obj. 14 Obj. 15	Obj. 10 Obj. 11
7	Obj. 14	Obj. 6	Obj. 2 Obj. 3 Obj. 6 Obj. 15
8	Obj. 7	Obj. 7	Obj. 7
9	Obj. 6	Obj. 13	

* Clusters formed by grouping objectives of similar importance, as determined by the average rating. Clusters do not have the same average rating among the groups.

This study fills a gap existing in research related to the planning of a methods course for prospective secondary science teachers. It is clear from the results of the study that educators whose primary concern is the teacher candidate represented a majority of the educators participating in this study and that a core of objectives related to teacher concerns was identified. It is important now to incorporate these findings into a methods course, to see if the results fulfill the expectations of instructors (primarily concerned with teachers) and prospective teachers (primarily concerned with self).

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